CLAIMS

1. A method for treating a subject, comprising:

administering a CpG nucleic acid to a subject infected with human immunodeficiency virus (HIV) in an effective amount to treat HIV infection.

2. The method of claim 1, wherein the CpG nucleic acid does not include a palindrome.

3. The method of claim 1, wherein the CpG nucleic acid is an adjuvant-type CpG nucleic acid.

4. The method of claim 1, wherein the CpG nucleic acid is a IFN-α-inducing CpG nucleic acid.

5. The method of claim 1, further comprising administering an anti-HIV therapy.

6. The method of claim 5, wherein the anti-HIV therapy is an inhibitor of HIV replication.

7. The method of claim 6, wherein the inhibitor of HIV replication is a protease inhibitor.

8. The method of claim 6, wherein the inhibitor of HIV replication is HAART.

9. The method of claim 5, wherein the anti-HIV therapy is a cytokine or a chemokine.

10. The method of claim 5, wherein the anti-HIV therapy is administered in a sub-therapeutic dosage and wherein the combination of the sub-therapeutic dose of the anti-HIV therapy and the CpG nucleic acid produce a therapeutic result in the treatment of HIV infection.

11. The method of claim 5, wherein the CpG nucleic acid is administered in a sub-therapeutic dosage and wherein the combination of the sub-therapeutic dose of the anti-HIV therapy and the CpG nucleic acid produce a therapeutic result in the treatment of HIV infection.

12. The method of claim 5, wherein the anti-HIV therapy is administered at the same time as the CpG nucleic acid.

13. The method of claim 5, wherein the anti-HIV therapy is administered prior to the CpG nucleic acid.

14. The method of claim 5, wherein the anti-HIV therapy is administered prior to the initial administration of CpG nucleic acid and the anti-HIV therapy is continued during the administration of the CpG nucleic acid.

15. The method of claim 14, wherein the anti-HIV therapy is terminated.

16. The method of claim 15, wherein the anti-HIV therapy is terminated at least one week after the initial administration of CpG.

17. The method of claim 5, wherein the CpG nucleic acid is administered prior to the initial administration of anti-HIV therapy and the CpG nucleic acid is continued during the administration of the anti-HIV therapy.

18. The method of claim 5, wherein the CpG nucleic acid and the anti-HIV therapy are administered in alternating cycles.

19. The method of claim 18, wherein the alternating cycles are monthly cycles.

20. The method of claim 9, wherein the cytokine is T-cell activating cytokine.

21. The method of claim 9, wherein the T-cell activating cytokine is IL-2.

22. The method of claim 9, wherein the chemokine is selected from the group consisting of RANTES and MIP-1α.

23. The method of claim 1, further comprising administering a non-steroidal anti-inflammatory agent.

24. The method of claim 23, wherein the non-steroidal anti-inflammatory agent is Piroxicam, Mefenamic acid, Nabumetone, Sulindac, Tolmetin, Ketorolac, Rofecoxib, Diclofenac, Naproxen, Flurbiprofen, Celecoxib, Oxaprozin, Diflunisal, Etodolac, Fenoprofen, Ibuprofen, Indomethacin, Ketoprofen, Etodolac, and Meloxicam.

25. The method of claim 3, wherein the adjuvant-type CpG nucleic acid has a sequence including at least the following formula:

5'[TCN$_1$TN$_2$X$_1$X$_2$CGTT]N$_3$[X$_1$X$_2$CGTT]N$_4$[X$_1$X$_2$CGTT] 3' (SEQ ID NO: 33),

wherein N_4 is about 0-26 bases with the proviso that N_4 does not contain a CCGG quadmer or more than one CCG or CGG trimer.

26. The method of claim 25, wherein N_4 is selected from the group consisting of nothing, any nucleotide, C, T, TT, TTT, TTTT, and TC.

27. The method of claim 25, wherein N_3 and N_4 are both TT.

28. The method of claim 25, wherein X_2 is T.

29. The method of claim 25, wherein X_1 is G.

30. The method of claim 4, wherein the IFN-α-inducing CpG nucleic acid comprises the following sequence

5' Y$_1$N$_1$X$_1$X$_2$CGX$_3$X$_4$N$_2$Y$_2$ 3' (SEQ ID NO: 73),

wherein G is guanine; C is unmethylated cytosine; X_1, X_2, X_3, and X_4 independently are single nucleotides; N_1 and N_2 are independently nucleic acid molecules each having between 0 and 20 nucleotides; N$_1$X$_1$X$_2$CGX$_3$X$_4$N$_2$ (SEQ ID NO: 74) includes a palindrome at least 6 nucleotides long that contains at least one CG; Y$_1$ is a nucleic acid molecule

having between 1 and 8 nucleotides comprising at least one modified internucleotide linkage; and Y_2 is independently a nucleic acid molecule having between 3 and 8 nucleotides comprising at least 3 consecutive Gs and at least one modified internucleotide linkage.

31. The method of claim 30, wherein at least one modified internucleotide linkage is a phosphorothioate modified linkage.

32. The method of claim 30, wherein Y_1 is comprised of at least 3 Gs.

33. The method of claim 30, wherein Y_1 is comprised of all Gs.

34. The method of claim 30, wherein Y_2 is comprised of at least 4 Gs.

35. The method of claim 30, wherein Y_2 is comprised of all Gs.

36. The method of claim 30, wherein Y_1 includes between two and five modified internucleotide linkages and Y_2 includes between two and five modified internucleotide linkages.

37. The method of claim 30, wherein the palindrome has a phosphodiester backbone.

38. The method of claim 1, wherein the CpG nucleic acid has less than or equal to 100 nucleotides.

39. A method for treating a subject, comprising:

administering a vaccine and a CpG nucleic acid as an adjuvant to a subject infected with or at risk of being infected with human immunodeficiency virus (HIV) in an effective amount to treat or prevent HIV infection.

40. The method of claim 39, wherein the CpG nucleic acid is administered at the same time as the vaccine.

41. The method of claim 39, wherein the CpG nucleic acid is administered before the vaccine.

42. The method of claim 39, wherein the CpG nucleic acid is an adjuvant-type CpG nucleic acid.

43. The method of claim 42, wherein the adjuvant-type CpG nucleic acid has a sequence including at least the following formula:

5'[TCN$_1$TN$_2$X$_1$X$_2$CpGTT]N$_3$[X$_1$X$_2$CpGTT]N$_4$[X$_1$X$_2$CpGTT] 3' (SEQ ID NO: 33),

wherein N$_4$ is about 0-26 bases with the proviso that N$_4$ does not contain a CCGG quadmer or more than one CCG or CGG trimer.

44. The method of claim 43, wherein N$_4$ is selected from the group consisting of nothing, any nucleotide, C, T, TT, TTT, TTTT, and TC.

45. The method of claim 43, wherein N$_3$ and N$_4$ are both TT.

46. The method of claim 43, wherein X$_2$ is T.

47. The method of claim 43, wherein X$_1$ is G.

48. The method of claim 43, wherein the adjuvant-type CpG nucleic acid has a sequence including at least the following formula:

[GTCpGTT]N$_3$[GTCpGTT]N$_4$[GTCpGTT] (SEQ ID NO:34).

49. The method of claim 43, wherein the adjuvant-type CpG nucleic acid has a sequence including at least the following formula:

TCGTCpGTT]TTGTCpGTTTTGTCpGTT (SEQ ID NO:35).

50. The method of claim 43, wherein the adjuvant-type CpG nucleic acid has a sequence including at least the following formula:

TCGTCpGTTTTGTCpGTTTTGTCpGTTTTT (SEQ ID NO:36).

51. The method of claim 43, wherein the adjuvant-type CpG nucleic acid has a sequence including at least the following formula:

TCGTCpGTTTTGTCpGTTTTGTCpGTTCCC (SEQ ID NO:37).

52. The method of claim 43, wherein the adjuvant-type CpG nucleic acid has a sequence including at least the following formula:

TCGTCpGTTTTGTCpGTTTTGTCpGTTAAA (SEQ ID NO:38).

53. The method of claim 43, wherein the adjuvant-type CpG nucleic acid has a sequence including at least the following formula:

TCGTCpGTTTTGTCpGTTTTGTCpGTT (SEQ ID NO:39).

54. A method for treating a subject, comprising:

administering a CpG nucleic acid and an anti-HIV therapy to a subject infected with human immunodeficiency virus (HIV) in an effective amount to treat HIV infection.

55. The method of claim 54, wherein the CpG nucleic acid is an adjuvant-type CpG nucleic acid.

56. The method of claim 54, wherein the CpG nucleic acid is a IFN-α-inducing CpG nucleic acid.

57. The method of claim 54, wherein the anti-HIV therapy is an inhibitor of HIV replication.

58. The method of claim 57, wherein the inhibitor of HIV replication is a protease inhibitor.

59. The method of claim 57, wherein the inhibitor of HIV replication is HAART.

60. The method of claim 54, wherein the anti-HIV therapy is a cytokine or a chemokine.

61. The method of claim 54, wherein the anti-HIV therapy is administered in a sub-therapeutic dosage and wherein the combination of the sub-therapeutic dose of the anti-HIV therapy and the CpG nucleic acid produce a therapeutic result in the treatment of HIV infection.

62. The method of claim 54, wherein the CpG nucleic acid is administered in a sub-therapeutic dosage and wherein the combination of the sub-therapeutic dose of the anti-HIV therapy and the CpG nucleic acid produce a therapeutic result in the treatment of HIV infection.

63. The method of claim 54, wherein the anti-HIV therapy is administered at the same time as the CpG nucleic acid.

64. The method of claim 54, wherein the anti-HIV therapy is administered prior to the CpG nucleic acid.

65. The method of claim 54, wherein the anti-HIV therapy is administered prior to the initial administration of CpG nucleic acid and the anti-HIV therapy is continued during the administration of the CpG nucleic acid.

66. The method of claim 65, wherein the anti-HIV therapy is terminated.

67. The method of claim 66, wherein the anti-HIV therapy is terminated at least one week after the initial administration of CpG.

68. The method of claim 54, wherein the CpG nucleic acid is administered prior to the initial administration of anti-HIV therapy and the CpG nucleic acid is continued during the administration of the anti-HIV therapy.

69. The method of claim 54, wherein the CpG nucleic acid and the anti-HIV therapy are administered in alternating cycles.

70. The method of claim 69, wherein the alternating cycles are monthly cycles.

71. The method of claim 54, further comprising administering a non-steroidal anti-inflammatory agent.

72. The method of claim 54, wherein the CpG nucleic acid has less than or equal to 100 nucleotides.

73. The method of claim 54, wherein the subject is treated with an anti-HIV therapy and an IFN-α-inducing CpG nucleic acid.

74. The method of claim 73, further comprising administering a vaccine and a CpG nucleic acid as an adjuvant.

75. The method of claim 74, wherein the CpG nucleic acid is an adjuvant-type CpG nucleic acid.

76. The method of claim 74, wherein the CpG nucleic acid is an IFN-α-inducing CpG nucleic acid.

77. The method of claim 73, wherein the anti-HIV therapy is stopped.

78. The method of claim 74, wherein the anti-HIV therapy is stopped.

79. The method of claim 77, further comprising administering a vaccine and a CpG nucleic acid as an adjuvant.

80. The method of claim 78, wherein the administration of the vaccine and a CpG nucleic acid is stopped.

81. The method of claim 80, further comprising re-starting administration of a vaccine and a CpG nucleic acid as an adjuvant.

82. The method of claim 73, wherein the IFN-α-inducing CpG nucleic acid therapy is stopped.

83. The method of claim 77, wherein the IFN-α-inducing CpG nucleic acid therapy is stopped.

84. The method of claim 83, further comprising re-starting administration of the IFN-α-inducing CpG nucleic acid.

85. The method of claim 84, further comprising re-starting administration of the anti-HIV therapy.

86. The method of claim 39, wherein the CpG nucleic acid is an IFN-α-inducing CpG nucleic acid.